03 October 2002

PMCD Safety Improvement Program for TOCDF

Introduction

The Tooele Chemical Agent Disposal Facility, known as TOCDF and located on the Deseret Chemical Depot (DCD), has been operating since 1996. Its mission is to destroy all the chemical weapons stored at the DCD. Since the responsibility for operations at TOCDF was assigned to the Assistant Secretary of the Army for Installations and Environment [ASA (I&E) late] last year, an effort to improve conduct of operations has been underway, with particular emphasis on worker safety.

Regardless of this effort, there was an exposure of workers to chemical agent. This safety improvement program is not a substitute for a corrective action plan that responds directly to the recommendations in the report of the Board of Investigation. However, it contains specific measures: (1) that must be taken at TOCDF by the Systems Contractor (EG&G Defense Materials, Inc., or EG&G), and by the PMCD Field Office to complete the cleanup of residual GB nerve agent remaining after completion of the GB weapons destruction in March; (2) to complete preparations for destruction of VX nerve agent weapons stored at DCD; and (3) to continually improve the safety of operations at TOCDF. This safety improvement program also identifies corrective actions that are to be put in place at other sites, to better assure that nothing like the event that took place on July 15, 2002 will recur at TOCDF or elsewhere.

A fundamental premise underlying this corrective action program is that the contractor is responsible and accountable for safety and performance. ASA (I&E) has indicated that a prerequisite for agent destruction is compliance with environmental permits and assurance of worker safety. PMCD requires the Systems Contractor to properly plan, coordinate and perform non-routine maintenance and complex work activities, maintaining configuration control during design changes or maintenance, and concurrently taking those steps required for worker safety (e.g., implementing OSHA Process Hazards Analyses).

Guiding Principles

As briefly noted above, the ASA (I&E) expectations are that PMCD facilities are operated safely, reliably and in compliance with environmental, safety and health requirements. To this end, two guiding principles have been used in the development of this corrective action program.

Contractor management controls must assure that safety is incorporated into the design, procedures, and administrative controls, in that order. In those circumstances where some aspects of designs are evolving, safety issues should be eliminated by design; in those situations that don't reasonably permit absolute prevention through design, written procedures have to avoid encountering safety problems, such as through developing administrative controls (e.g., lock out/tag out with independent verification etc.), or through instituting positive controls to restrict access to hazardous areas (e.g., locked doors with key control).

In all events, worker safety is of paramount concern and should not be compromised due to unique situations or non-routine activities. Accordingly, to ensure workers are sufficiently protected when doing non-routine work in areas that contain, have contained, or could contain agent or other hazardous materials, the work procedures will require the use of conservatively chosen personal protection.

The Event

TOCDF had completed GB agent destruction operations in March 2002. Work was underway to convert the facility in order to prepare for a yearlong campaign to destroy VX chemical weapons. Concurrently, the contractor was also doing work to improve plant performance. As part of this effort, a change that had been made to a Primary Liquid Incinerator #1 (LIC-1) in the December 2001 –January 2002, timeframe during GB operations, was also going to be done to the Primary Liquid incinerator #2 (LIC-2) in July 2002 during the outage. On the morning of July 15, 2002 a two-man team was directed to perform this work on LIC-2. During the course of this work, GB agent was encountered and a worker was contaminated with material that contained residue agent. Attachment A contains a more detailed narrative of the background circumstances, a summary description of the event and an abbreviated synopsis of the underlying problems that allowed the event to occur.

Both EG&G and the Army conducted investigations of this event.

Safety Improvements - General

This safety improvement program is an integrated approach for TOCDF. Several items have also been identified that require action by other PMCD sites and other elements of the Army. These items are also included herein. It should be noted that this safety improvement program is not a substitute for a corrective action plan that responds directly to the recommendations in the report of the Board of Investigation.

Corrective Action: Immediate Actions to Better Protect Workers

Upon learning of the agent exposure on July 15, 2002, PMCD ordered that all operations related to GB to VX changeover were to be suspended at TOCDF, except for those activities that were required to maintain compliance with the existing environmental permit and to ensure that engineering controls were in place to prevent agent migration. EG&G Defense Materials (EG&G) immediately complied. EG&G subsequently also began to take corrective action arising out of its own investigation, and in response to expectations for safe operations by the ASA (I&E). What follows is a summary of those measures that have to be performed to better assure that no worker is asked to do work at TOCDF that carries a significant risk of exposure to residual GB nerve agent that remains in the facility, or unless specific exceptions are approved, in writing, by the Army.

As a general matter, no entries shall be made into any areas within the exclusion area boundary that, at any time, contained GB nerve agent – either liquid or airborne – unless protected by the conservatively selected equipment, until work planning has been developed appropriate to each specific type of activity, until procedures to do the work are in place and workers are trained in application of those procedures, and until contingencies are in place such that work is immediately suspended and safe exiting will occur should that be required.

The above general measures will apply to any activities related to the completion of changeover from GB to VX agent destruction operations.

Complete Work Place Safety and Operational Safety Improvements, Prior to VX Destruction Operations, and While Compensatory Measures are in Place

In order to promote and foster contractor ownership and accountability for operational facility safety and worker safety, specific improvements in management controls are also necessary. The following specific action items are required before VX destruction operations can commence at TOCDF:

1. Modify the Limiting Conditions of Operation (LCOs) and related procedures/drawings associated with the emergency electrical generation and distribution systems, the uninterruptible power system, and the HVAC system to assure that these critical systems are operated within known, safe limits. Verify that operators have been trained and will perform in accordance with the revised procedures.

   Included in this program should be the identification of key worker safety features, critical safety systems, components, and essential support systems such as electrical power, identification and use of the appropriate component and system vendor manuals, incorporation of associated recommendations for surveillance and maintenance into plant administrative control systems (including procedures), and cross walk with the operating and maintenance procedures. Operator and shift training must be completed prior to the start of VX agent destruction operations;

2. Defining the steps and milestones for better managing control room alarms.

   Prior to start of VX destruction operations, an action plan must be submitted to and approved by PMCD that identifies the major steps to be taken over the next 12 months to ensure that the operators in the control room are able to distinguish between situations that require their immediate intervention, and situations that do not. A phased or segmented approach that results in completed upgrades to the control room alarms prior to start of a given munitions campaign, starting with VX rockets, is acceptable.

3. Complete engineering modifications to HVAC system to address RAC 2 issue from Parson's study of the ANCDF HVAC System and close a TOCDF identified HVAC RAC 2 finding.

4. Provide a lessons learned program consistent with PMCD direction of June, 2002 including development and institution of revised EG&G policies and procedures for conducting critiques and investigations for incidents, unusual occurrences or accidents, and communication of the events and results with management and the workforce. Evaluate the effectiveness of existing employee concerns program at TOCDF with respect to its ability to identify and highlight potential worker safety issues without retribution or fear of reprisal. PMCD is to develop the essential attributes of a successful employee concerns program for all PMCD sites that foster identification of potential safety issues to their supervisors, direct management consideration and resolution, provide feedback to the worker, and provide for a proactive PMCD role.

5. EG&G Management Responsibilities and Accountability:

   Issue a policy statement that clearly defines the roles and responsibilities for senior EG&G site management and the process for interaction among Quality Assurance, Engineering, Safety, Environment, Operations, and Maintenance to ensure a safe working environment.

   Provide to and obtain PMCD approval for a management monitoring plan prior to start of VX destruction operations. This plan must provide for a formal EG&G management follow-up and surveillance of plant conditions to validate satisfactory implementation of corrective actions for actions plans, and on a subsequent recurring basis (at least weekly) to validate acceptable maintenance of the safety bases for plant operations. Such a monitoring program should include a formal process that requires EG&G management and supervisors to conduct independent monitoring tours and observations of work in progress, to record management observations of weaknesses or deficiencies, tracking/trending of such identified issues, and ensuring satisfactory and timely resolution and closure.

6. Revise and implement an improved shift turnover process to maximize the preparedness of the oncoming shift to operate the facility safely, including:
   a. Validation of LCO's
   b. Review of work logs, procedure modifications, and system configuration changes
   c. Facility tours
   d. Develop and implement a Plan of the Shift meeting to ensure coordinated work activities

7. Review operating practices that workers have initiated to "get the job done" without management approval, engineering evaluation, or procedural modification.

8. With respect to Agent bearing systems:
   a. Evaluate and establish the plant AE (agent expected) boundaries.
   b. Evaluate the atomization gun "plugging" phenomenon that has historically resulted in agent flow blockages. Included in this evaluation shall be the reliability and calibration of pressure indicators, flow sensors, temperature sensors, feed regulator valve and agent feed pump. Identify options for dealing with plugging during operations that do not rely on pressure spikes to clear blockages and describe administrative and procedural changes that incorporate revised management and technical direction.
   c. As part of the "plugging" evaluation, assess the adequacy of and frequency of replacement of strainers in the agent drain collection and agent feed systems. Include in this evaluation the technical basis for deviating from the original installation, recommended by the original facility designer. Replace strainers in the agent feed system with appropriately sized ones to collect particulates that might otherwise plug the LIC "agent guns."
   d. Revise PLC Software to reduce/eliminate potential for quickly cycling the agent feed control valve.
   e. Identify critical components of disposal systems to ensure that these critical components are operated within known, safe limits. Verify that operators have been trained to perform in accordance with the revised procedures.

The following specific action items are required before routine toxic area operations can commence without direct and specific government approval:

1. Review and modify incident response protocols and procedures, with emphasis on agent monitoring, medical assistance, and decontamination practices, including:
   a. Evaluate medical staff training and appropriateness of actions associated with the July 15 incident;
   b. Evaluate adequacy of decontamination procedures and equipment;
   c. Evaluate procedures for evaluating physical condition of exposed individuals; and
   d. Evaluate plans for use of monitoring resources at both TOCDF and DCD

2. Implement an augmented maintenance program for control of non-routine activities. The program shall be consistent with the following principles of enhanced work planning:
   a. Integrated planning
   b. Clear, precise scope of work
   c. Hazard assessment
   d. Control selection based upon the hazard assessment
   e. Documented and approved work instructions
   f. Safe performance of work
   g. Senior management review and approval prior to work authorization
   h. Post-evolution feedback is collected and incorporated into future work planning to improve performance

3. Perform all non-routine work in toxic areas, or on safety and control systems (including Software modifications and engineering design packages), in accordance with the controls of the augmented maintenance program.

4. Develop and implement a confirmed agent exposure evaluation and care program, including:
   a. Long-term care and surveillance
   b. Availability of independent evaluation and counseling for worker and family

Corrective Action: Validation of Key Facility Design Bases at TOCDF, Prior to VX Destruction Operations

System Contractor shall establish a validated baseline of facility design of agent bearing systems, connected systems including the HVAC system, and review system modifications and component repairs to reflect such modifications (for example, use of "redline" to reflect changes) in controlled copies of piping and instrument diagrams (P&IDs) in the control room to reflect "as built" conditions in the plant. This validation may be accomplished through the use of a walk-down. Complete a review of engineering and maintenance databases and records to identify potential inconsistencies. Verify the agent monitoring systems for proper identification of the presence or absence of agent at the levels of detection appropriate to the safety control points established for the operation.

Corrective Action: Implement a More Effective PMCD Performance-Based Oversight Approach throughout PMCD, and at TOCDF Prior to Start of VX Operations

In response to ASA (I&E) direction to develop an enhanced oversight paradigm that promotes more observation and evaluation of work in progress, and fosters contractor accountability for worker protection and safe facility operations, PMCD has developed the Performance Based Assessment Program to be implemented by every PMCD field office, reference Attachment B.

A Performance Monitoring and Surveillance Plan shall be developed by each PMCD Field Office. It will describe the oversight process to be applied for TOCDF. Each Plan shall identify the roles and responsibilities of government oversight personnel, functional areas to be monitored, communications with the contractor, identification and resolution of technical issues, use of support contractors, means of conducting oversight, and management expectations for scope and depth of first hand observations. Each plan should include compensatory measures for those items requiring additional time to implement (for example, staffing and qualification of facility representatives). The TOCDF plan must be in place and approved by PMCD prior to start of VX operations. Adherence to that Plan will be validated through monthly, independent assessments reporting directly to the ASA (I&E).

Corrective Action: EG&G Corporate Validation of Operational Readiness for VX Operations

EG&G shall develop and propose start-up criteria for determining readiness of TOCDF for VX Operations. Using these criteria, EG&G shall conduct a corporate evaluation of TOCDF operational readiness and submit to PMCD a report indicating how the results, and any necessary compensatory measures, demonstrate facility structures, systems and components, programs, procedures and personnel are ready to support safe and reliable VX Operations.

Validation of Readiness for VX Operations

To ensure effective implementation of these actions, PMCD validation of compensatory measures to be used during remaining GB to VX changeover operations is required.

EG&G will be required to implement the necessary corrective actions identified herein, ascertain the completeness and effectiveness of such actions and conduct a corporate readiness assessment. Subsequently, EG&G will notify the PMCD Field Office of its readiness to conduct VX agent destruction activities and operations. The PMCD Field Office should have been conducting its oversight, using the revised surveillance and oversight plan developed in response to the requirements of Attachment B.

The Army will identify and task a corrective action follow-up team consisting of select members of the accident review board & other technically knowledgeable personnel. Specific lines of inquiry will be developed to ensure the scope of follow-up team reviews encompass the needs identified in the Board of Investigation Report. The Army team will provide its findings to the ASA (I&E). PMCD shall provide weekly reporting to ASA (I&E) on the status of corrective action implementation, advise when various types of activities leading to GB to VX changeover can commence, and advise when activities leading to VX destruction operations should be allowed to commence.

Corrective Action: Complete the Pre-event Performance Improvement Program at TOCDF, Prior to Mustard Destruction Operations

The following initiatives were identified and in the process of implementation prior to the July 15, 2002 exposure incident. These initiatives will continue per an approved schedule except where specific activities have been accelerated to support the safe startup of VX operations:

1. Complete incremental upgrades to the balance of the LCOs within 12 months, with monthly progress reports. Implement a validated set of safety LCOs for all key safety systems and components prior to start of mustard destruction operations. This program shall include all safety-related systems such as fire protection, life support air, essential hydraulic systems (e.g., hydraulic operators for interlocks) and safety monitoring and instrumentation systems.

2. Apply the alarm reduction program, after approval by PMCD, in a segmented manner so that prior to the start of an individual monition or bulk container campaign (starting with VX rockets), the alarms, including indicating lights and associated audible signals, will be properly modified to discriminate between safety alarms and those alerts associated with process reliability. Provide the companion program for mustard operations prior to the start of the changeover outage for mustard operations.

Corrective Action: Validation of Effective Implementation of Configuration Control at TOCDF, Prior to Mustard Destruction Operations

In order to ensure proper maintenance of the design basis on a continuing basis for designated key safety systems and components, configuration control of such systems and components during operations, maintenance, surveillance testing and repair, requires monitoring by the contractor management to ensure adherence to all procedures that have the potential to introduce unplanned changes. In addition to spot check quality control inspections and periodic quality assurance audits, real time monitoring of and involvement in operations and maintenance activities by systems engineers is required.

Each System Contractor will be directed to establish a design-engineering group, with clearly defined roles and responsibilities and staffed with technically qualified and experienced managers and engineers to perform the role of the Facility Design Authority. Engineering roles and responsibilities are also to be defined with respect to engineering participation in work planning and oversight of operations and maintenance activities.

Corrective Action: Verified vulnerability assessments & improvement programs at all PMCD sites

1. Improve contractual management by PMCD of contractual performance:
   a. Award fee management
   b. Announce and issue fee impact letter associated with this type of event

2. Improve effectiveness of PMCD oversight:
   a. Issue PMCD-wide call for Lessons Learned assessment
   b. Institute facility representative (strong technical presence) program

3. Assess the role of the PMCD training facility and associated resources in ensuring technical knowledge; skills and qualifications of contractor and government personnel are being reinforced through periodic refresher training. Assure that training protocols for "conduct of operations" are in place and scheduled for all managers.

4. Ensure that the specific hardware problems with LIC gun piping and valve performance are corrected at Pine Bluff, Anniston, and Umatilla

5. Ensure that safety-based Limiting Conditions of Operation (LCOs) that define the allowable conditions for safe operation are established, including a discussion of the underlying qualitative safety bases that provides the rationale for the LCO, and associated compensatory measures when such LCOs are not satisfied.

Summary Remarks

Senior Army and PMCD leadership made clear their expectations for a strong, effective safety-first culture, prior to the accidental exposure of a worker at TOCDF on July 15, 2002. It is evident that needed changes are not yet in place.

There will be no tolerance of work practices that put workers at risk and no tolerance for management, either in PMCD or in contractors, to penalize rather than promote workers' attempts to create a safer environment for themselves or their co-workers.

03 October 2002

Attachment A
Summary Narrative of July 15, 2002 Event at Tooele

Background

On the morning of July 15, 2002, a two-man maintenance work team conducted a toxic area entry for maintenance in the Primary LIC 2 Room. Work consisted of removing a section of air purge piping (used to purge agent from the agent feed line immediately following an agent feed cutoff) and waiting for two 3-minute ACAMS sampling cycles to measure GB levels. It was determined in the pre-entry meeting that if GB measurements were below the Limit of Quantification (LOQ), 0.2 Time-Weighted Average (TWA), the workers would unmask, detach a pressure gauge from the removed pipe and reinstall the gauge on a prefabricated section of replacement piping with a new low-pressure regulator, and install the replacement piping in the air purge line. If GB levels were above LOQ, the workers were to stop work activities, abort the entry, and exit to the Secondary LIC 2 Room, pulling the agent sampling line with them. No other verification of system integrity was conducted.

The pressure regulator replacement was required due to a problem, experienced during the GB destruction campaign, with the initial design of the Primary LIC agent feed air purge. When agent flow to the Primary LIC is stopped, the air purge of agent from the Primary LIC Gun was delivered at a pressure differential from 0 to 18 pounds per square inch, gauge (psig). This pressure differential would cause residual agent in the feed line to be fed to the furnace at higher than normal flow rates, resulting in spikes in carbon monoxide levels and alarming of monitors in the Primary LIC effluent stack. (The spiking of carbon monoxide levels was not allowed under the State Resource Conservation and Recovery Act (RCRA) permit and the monitor alarms would require the site to mask.) To correct this, a new regulator system consisting of parallel regulators set at ~7 and ~18 psig, respectively, was to be installed in place of the present regulator. This new regulator system was designed to reduce the initial flow rate of residual agent into the burner gun to an acceptable level by initiating the air purge at a pressure of 7 psig and subsequently ramping the air purge pressure up to 18 psig. As operating experience in Primary LIC 1 has shown, this two-stage ramp-up of purge air pressure keeps the burner flame at a higher temperature than a single-stage 18 psig purge and, prevents the problematic carbon monoxide spikes. The System Contractor had prefabricated the replacement section to allow easy replacement.

PMCD TOCDF Field Office had approved the design change request for Primary LIC 1 on July 31, 2001 and for Primary LIC 2 on August 23, 2001. The work was to be done sequentially. Furthermore, each design change was accompanied by six temporary modifications. On August 28, 2001 a Maintenance Work Request was prepared by Engineering to install the new regulator on Primary LIC 1. The work on Primary LIC 1 was started in November and the new regulator was put into service on December 14, 2001. Work was conducted by employees wearing Demilitarization Protective Ensembles (DPE), a type of Level A personal protective equipment (PPE). GB operations in Primary LIC 1 resumed after replacement and continued until early January, when the incinerator was shutdown to repair agent leaks, including cracks in the flexible hose connecting the agent line to the atomization gun. After resuming operations, on January 17, 2002 agent was observed via camera to be leaking from the newly installed air regulator. This discovery was important since it was evidence of agent being present outside the piping boundary established for containing agent.

This migration of agent was apparently unknown to most plant workers, including the workers performing the work on LIC-2 and the support team involved in the July 15 event. On January 16, 2002, GB levels in excess of 511 TWA were detected in the Primary LIC 1 Room and were caused by liquid GB agent leaking from the newly installed regulator on the air purge line beyond the AE boundary of the air purge line. The System Contractor determined that agent had migrated upstream of two piston-operated check valves and an air-actuated ball valve. This same arrangement of valves also exists on Primary LIC 2. On January 17, 2002, a maintenance team entered the Primary LIC 1 Room in DPE and replaced the valves as specified in a temporary change package.

Although the air purge regulator valve in question was replaced during November and December of 2001, and the attendant leaking block valve and check valves had been replaced in the Primary LIC 1 Room on January 17, 2002, the same attendant valves for the air regulator in the Primary LIC 2 Room were not planned to be replaced.

Follow-up testing is necessary to verify that the valve change-outs on Primary LIC 1 have corrected the problem. The check valves are piston-type devices that are neither vapor tight nor rated for service with liquids containing suspended solids, and therefore may fail again. Similarly, the original design and installation for the block valve was a gate valve design, which was reflected in the P&IDs, but which was subsequently changed to a ball valve design. In January 2002, this block valve was replaced with a globe valve design. Controlled P&IDs were not revised to reflect the different valve designs nor were they modified to reflect that agent was observed in piping up to the air regulator valve. Agent expected (AE) boundaries are indicated on the P&IDs to alert operators.

Although the problem encountered with leaking valves was recorded in shift operating logs on January 16 and 17, 2002, the discovery of agent in the Primary LIC 1 air purge line had not been reported by the System Contractor to PMCD's then programmatic lessons learned program as a design or safety deficiency and no site-specific lessons learned program, managed by the contractor, was in place.

The PMCD Field Office personnel conducted a review of the Primary LIC 1 air purge system repair work documentation after the work was done and made several observations. These observations were sent as recommendations for the work to be done on LIC-2 (February 4, 2002 letter to the System Contractor). The letter was considered advisory with no request for a response.

The modification for Primary LIC 2 was scheduled to take place the week of July 15, 2002. The Maintenance Work Request for the Primary LIC 2 air regulator was prepared by Engineering on February 15, 2002. The work order reflected none of the recommendations made by PMCD, even though the person preparing it was in receipt of the letter.

The work scheduled for 15 July, 2002 in the Primary LIC 2 involved disconnecting the air purge line upstream of the air-actuated ball valve, which is designated in the facility's P&ID as the outer "AE" (agent expected) boundary of the air purge line. Since the P&ID indicated agent was not expected in the section of piping to be removed and the Primary LIC 2 gun lines had been properly purged, it was assumed the highest agent-related hazard would involve disassembly of piping that had not contained agent and that had previously been externally decontaminated to the 3X level. Level 3X indicates the exposed surfaces may have previously been contaminated with agent but had been decontaminated to

the LOQ and verified agent-free through use of an ACAMS monitor. The Primary LIC 2 Room, including the piping being worked on, was referred to as 3X, which indicates the exterior was exposed to agent vapor and decontaminated to the LOQ limit by an ACAMS monitor. Based on analysis of assumed hazards, initial plans were to select Level C PPE for the entry. But the workers preferred the greater field of vision and comfort provided by the industrial respirator, and concurrence from the Safety Representative using SOP-109 as a guide, Level E PPE was selected and documented in the Safe Work Permit. The Level E PPE consisted of an industrial respirator, leather boots and gloves, and coveralls. The industrial respirator is approved by the National Institute for Occupational Safety and Health (NIOSH). This industrial respirator has been approved by Headquarters, Department of the Army Safety Office for up to 50 TWA but was downgraded by the System Contractor to 1 TWA. Further, it was discussed, and agreed, that in the event an agent monitor within the Primary LIC 2 Room alarmed, Workers 1 and 2 would evacuate to the Secondary LIC 2 Room – as opposed to the normal egress route through the air lock adjacent to the Primary LIC 2, taking the spooled ACAMS sample line with them for monitoring in the Secondary LIC 2 Room. It was also agreed that the removed section of 3X piping would be disposed of as hazardous waste in the Pollution Abatement System (PAS) roll-off, with final disposal in a hazardous waste permitted landfill.

Due to the changeover of agent feed from GB to VX, fixed monitors within the plant were set to measure VX. In order to measure GB during the work activities, a portable ACAMS was placed in a Monitoring Room adjacent to the Primary and Secondary LIC 2 Rooms, with the sampling line running to the Primary LIC 2 Room. The ACAMS had a designated reader (also in the Monitoring Room) in telephonic contact with the Control Room Operator who was in radio contact with the workers. The ACAMS Reader was to contact the Control Room Operator if the ACAMS read above 0.2 TWA GB.

The supervisor of the activities, the Operations Supervisor, was also located in the Monitoring Room adjacent to the Primary and Secondary LIC 2 Rooms.

Concurrent with, but unrelated to, the pressure regulator replacement, a two-man team (referred to as the Inspection Team) was in the upper level of the Secondary LIC 2 Room conducting non-destructive testing of a pipe weld. The work involved with the non-destructive testing was discussed at a 0630 shift turnover meeting (on July 15, 2002) but the discussion was not documented.

Operating practices during agent operations also may have an impact on valve leakage. Process Data Acquisition and Recording (PDAR) (control system) printouts show that the normal operating pressures in the agent feed line are approximately 40 psig but transient pressures as high as 180 psig may develop when Control Room Operators take manual control of the regulator valve and insert signals to stroke agent feed control valves to create such pressure pulses. Apparently, such pulses have been found to clear agent flow blockages, as evidenced by improved incinerator performance. These blockages were suspected to be in the burner gun. The effects of such pressure spikes on valve leakage in interconnected systems or the agent feed line are not known.

During the time of the LIC 2 incident, agent was not being processed. The plant was in a maintenance changeover mode converting equipment and processes from demilitarizing and destroying munitions and bulk containers of chemical agent GB to processes for destroying chemical agent VX.

Event Summary

There are two essentially identical air purge systems associated with the LICs. A design change to one was satisfactorily performed during the months of November and December of 2001 while the plant was operating. Subsequent problems were identified in January 2002 that required additional repair work to the system. Agent was found to be leaking from the newly installed air regulator. This additional work involved replacing two check valves and an air operated block valve, which were intended to prevent backflow of agent into the air purge system. The leaking air regulator also had to be replaced. These repairs were done without incident, inadvertent agent release or inadvertent agent exposure to any individual. Proper PPE and work planning and procedures were used. Two problems were, however, encountered. First, the newly installed air regulator valve that was declared operational on December 14, 2001 from which agent was found to be leaking on January 16, 2002 was never examined to understand the reason for agent to have leaked from the valve itself (one can speculate a number of causes, but an in-depth engineering examination of valve internals was not done and the valve was replaced with one of similar design). Second, the failure to have included in a lessons learned program the fact that agent was found to be present in a portion of the air purge system where no agent was expected to be. Since the second system was scheduled to undergo the same design modification to the air regulator in a few months, it would have been appropriate to reflect this experience with the failure of the check valves and block valve in the preparation of the work package for the second system. The PMCD Field Office did put the contractor on notice that such action was prudent but did not require a formal response that appropriate actions, such as verification of integrity, were in fact incorporated into the work planning. However, the fact that the repairs themselves were completed for the first repair without incident demonstrates that proper procedures, practices, and work planning were in effect during a time when the plant was operational.

Insights

The major difference between the modification for the first and second LIC systems was plant status. In contrast to the situation in January, when agent was present in the plant and the plant was operational, during the second modification in July the plant was in an extended outage making preparations for changeover to VX operations. When the plant was operational, a more cautious approach was used. Consequently, once the plant stopped operations, and systems were apparently flushed, purged, and decontaminated, it appears that the normal management oversight and engineering involvement was not the same and management oversight was relegated to a much lower supervisory level. Since the plant was assumed to be decontaminated, a false assumption since only external surfaces were declared agent free, the modification was performed under a different set of procedures, and assumptions were made as to internal air system integrity without confirmation of such integrity, as was suggested by the PMCD Field Office in February. Numerous sources of information, such as documentation in shift log books, existed that should have made operating and maintenance personnel aware of the prior experience with back leakage but were not used. This raises questions about the technical sufficiency and adequacy of shift turnover procedures. In addition, the cognizant Systems Engineer who was aware of the problems encountered with the first repair did not participate in the work planning for LIC-2, although he did prepare the work request for which the maintenance group wrote the repair procedure and prepared the necessary permits.

Once the incident occurred and a worker was inadvertently exposed, additional weaknesses were identified in the onsite emergency response relative to monitoring, decontamination, and medical evaluation of contaminated individuals. Once the agent alarm sounded, it took approximately one hour to transfer the affected personnel from the vicinity of the LIC-2 rooms. They were transferred without undergoing any decontamination or medical observation or evaluation. Upon arrival in the onsite medical center, it required about 4 hours to complete decontamination of a worker. During this time medical personnel observed him through a glass window. This worker did not receive hands on medical observation or evaluation for about five hours from the onset of the event.

To develop a root cause(s) for this incident, one must first recognize that it entails non-routine maintenance at a time when there was limited agent in the plant. As demonstrated through experience, the fundamental problem of agent back leakage into an air purge line was properly managed during the time period when the plant was operational and agent was present in the plant in significant quantities.

The root causes of the July 15, 2002 GB exposure of the TOCDF worker can be summarized as:

- The System Contractor's failure to establish TOCDF-specific lessons learned program that disseminated the information gained from experience to the workforce.

- Poorly defined roles and responsibilities for the safety, QA, maintenance and engineering groups that did not require active participation and oversight of non-routine work.

- A lack of management involvement and oversight of non-routine activities during an outage involving many changes to the plant in preparation for a new agent campaign.

When considering all of the above collectively, there appears to be a common theme; one can refer to it as "safety culture." In the context of this plan, the term "safety culture" is used it to describe a set of attitudes and attributes reflected in workers, supervisors, and managers that safety is the fundamental priority and prerequisite for doing work. A superior safety culture is evidenced when workers, supervisors, and manager:

- Work in a structured, formal and disciplined manner that emphasizes doing the right job correctly the first time, without having to rely on after the fact quality control checks to make sure the work was done properly.

- Rely to the maximum extent possible on engineering and administrative controls to design in safety protocols and safety features to protect the workers rather than solely relying on PPE.

- The workforce participates in identifying near misses and potential problems, before they become self-evident, without fear of reprisal to improve the way business is done and thereby improving procedures and deterring recurrence of problems (the essence of a lessons learned program).

- Promote technical inquisitiveness and assume that "Murphy's Law" (if something can go wrong it will go wrong) may be applicable rather than relying on optimistic assumptions when hazardous materials are potentially involved.

- Maintain and reinforce the responsibility of every individual to keep safety as the fundamental priority and prerequisite for doing work.

Such attitudes cannot be mandated or legislated. However, striving to achieve such attitudes requires management reinforcement to the workforce every day that employees are able to, and expected, to participate in identifying weaknesses in plant administrative controls and procedures, be encouraged to raise potential safety issues to their supervisors, and if necessary, use the employee concerns program. The workforce must understand the role of lessons learned to foster continuous improvement, this requires an effective lessons learned program that is well communicated to the workers. People make mistakes and mechanical equipment can break down without warning. To help minimize the potential for making mistakes, refresher training and periodic reminders through team meetings are used to promote and foster good habits and practices. Accordingly, a "safety culture" that promotes the above attributes and attitudes can more effectively deal with abnormal situations that are expected to occur, before they deteriorate to the point of becoming an incident or accident.

03 October 2002

Attachment B

PMCD Field Office Performance Assessment

Background:

PMCD has historically performed its oversight of the Systems Contractor (Contractor) using a compliance-based approach. The PMCD field office (FO) has also exercised approval authority for facility system modifications as well as for procedure changes. Having approved modifications and procedures, the FO predominately evaluated the Contractor's compliance to FO approved procedures, contractually mandated Army regulation requirements and regulatory permits requirements using "paper-based" audits and surveillances. While surveillances observing operations or work activities were completed, performance based assessment was not the norm. Consequently, the FO daily evaluations focused on the Contractor's compliance to requirements instead of the contractor's performance with respect to the overall safe and reliable operation. This approach resulted in essentially absolving the Contractor of accountability for safe operations, established regulatory imposed RCRA permit requirements as the primary basis for safe operations, and did not support continual improvement in operations to reflect lessons learned.

New Approach:

To make the Contractor clearly responsible and accountable for worker protection and safe facility operations, each PMCD FO will make sure that the Contractor properly exercises its role for assuring the technical sufficiency and adequacy of the facility design and the responsibility for the development and approval of site programs and procedures. In addition, the PMCD FO will change its role from compliance-based oversight to performance-based assessment to improve the Contractor's performance in the areas of worker safety and operational reliability. This in no way implies that the FO will not ensure that the Contractor complies with applicable requirements, but rather the FO will focus on evaluating the Contractor's performance of work activities in terms of managing, planning, and executing applicable requirements. The FO will establish an assessment program that focuses on the Contractor's operational performance, rather that the adequacy of the contractor's documentation. As the FO assures the contractor exercises its responsibilities for safety, configuration management, and lessons learned, the Contractor must have the authority to approve and implement design changes as well as modify facility procedures. Accordingly, the Contractor must be accountable for developing a strong, technically based engineering group capable of implementing this process and providing technical oversight within the Contractor's organization.

The PMCD organization, at all levels, will hold the Contractor accountable for implementing the Army's expectation and performing work in accordance with the appropriate standards and requirements for safe operations.

The Field Office Assessment Program will consist of three parts:

1. Defined Roles and Responsibilities for the Field Office;
2. Policy for Monitoring Work Activities, including training/qualification of staff;

3. Policy for Communicating Findings, Expectations, and Performance Evaluation to the Contractor.

2. Defined Roles and Responsibilities of PMCD Field Offices:

The PMCD will develop/modify policy statements, proposed contract modifications, and procedures to define the roles and responsibilities of the Field Offices, including:

a. Oversight of the execution by the Contractor's management of facility design and procedures/procedure modifications, including a clear definition of the Contractor responsibilities and performance expectations;
b. Implementation of a FO Management Walkthrough Program;
c. Definition of the roles, responsibilities, training and qualification of Facility Representatives including defining "STOP WORK" authority and responsibilities in emergency and casualty situations; and,
d. Definition of the roles, responsibilities, training and qualification of subject matter experts to complement the Facility Representatives.

Under no circumstances are PMCD personnel, other than those specifically identified in the contract, authorized to provide technical direction of any kind to the contractor. If the contractor needs to expend time or resources to provide a written response, develop or collect data, or in any manner develop information not readily available, to any request or question from the PMCD FO, all such requests shall require the concurrence of the PMCD Site Manager. Under no circumstances are PMCD Field Office support contractors authorized to represent the government, hold one on one meetings with the contractor, or imply that they represent the government staff, in any dealings with the contractor. At those sites where a shift engineer function exists, it will be transitioned to that of a facility representative to provide broader coverage in scope and technical depth than heretofore expected. PMCD personnel currently conducting monitoring functions will be provided opportunities to either perform as subject matter experts or facility representatives, based on their technical background and qualifications.

3. Monitoring Work Activities:

PMCD will develop policies that require the FO to focus on monitoring work in progress. To accomplish this objective in the long term, the FO will develop and implement a Surveillance, Audit, and Evaluation Program with standards and metrics to monitor Contractor performance and PMCD will continue to take steps to evaluate the effectiveness of the FO Performance Assessment Program. Such a program will include, as a minimum, daily observation of shift operations, maintenance and laboratory activities. The program will also delineate those functions and activities to be observed on a weekly, monthly, quarterly and annual basis. This FO program will focus on the Contractor's performance in the following technical areas:

a. Conduct of Engineering, Training, Safety, Control Room Operations, and Post-Work Activity Critiques;
b. Work planning and execution of both routine and non-routine work activities, including the roles of Engineering, Safety, Maintenance, Quality and Operations;
c. Worker safety, participation in work planning and safety inquisitiveness;

d. Agent destruction and supporting facility operations;
e. Environmental Monitoring;
f. General housekeeping;
g. Self-assessments and internal audits;
h. Unusual occurrence identification and reporting;
i. Lessons learned program;
j. Emergency response preparedness & effectiveness;
k. Medical support & industrial hygiene; and,
l. Analytical laboratory operations.

More effective work monitoring can and will commence immediately at each site using Conduct of Operations principles; there is no reason to defer necessary changes until an approved Surveillance, Audit, and Evaluation Program is in place. The direction of the change is clear – to foster more direct observation of work in progress that can have a direct or indirect effect on worker safety, the environment and public health and safety. Questions of implementation will be addressed on a case basis until the approved program has been issued.

A similar program for non-technical functions, such as procurement, public affairs, legal, etc. will also be established relying on performance-based principles.

4. Communication:

Clear and timely communication with the Contractor is one of the key aspects of this proposed change in the FO's monitoring of the Contractor's performance. On a daily basis, the Facility Representative's logs as well as other FO personnel observations (e.g., handwritten notes) will be provided to the contractor for information, consideration and verification of technical accuracy. At least monthly, the PMCD Site Manager will meet with the Contractor Site Manager to identify and discuss significant observations and trends in the Contractor's performance. For significant issues, the FO will transmit findings in writing requiring a formal Contractor response.